The characteristics of geriatric patients managed within the resuscitation unit of a district-level emergency centre in Cape Town

By

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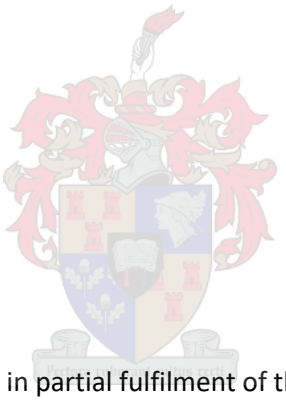

Research assignment presented in partial fulfilment of the requirements for the degree

Masters of Medicine in the Faculty of Medicine and Health Sciences

at Stellenbosch University

Supervisor: Dr Daniël Jacobus van Hoving

December 2021

Declaration

By submitting this dissertation electronically, I, Natalie Mukamweele Simakoloyi, declare that the entirety of the work contained herein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third-party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: 23/08/2020

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Part A: Literature review

Introduction

The exponential rise in the elderly population is a global phenomenon. People living longer than 60 years have doubled since 1980, to 962 million in 2017. Projections are that it will double again by 2050. The demographic transition of the global population age is as a result of a decline in fertility of the younger population combined with improvement in survival of the general population; resulting in an inevitable increase in the proportion of older persons [1].

Two-thirds of the worlds geriatric population lives in developing countries and Japan has the world's most aged population (33% older than 60 years) [1]. The aging population (>60 years) in South Africa represents approximately 9% (5.3 million) of the nation [2], with the Gauteng province having the largest percentage (29%) [2]. In the Western Cape, the total number of geriatric persons are estimated at 447 000, translating into 6.5% of the province's population [2].

The global average life expectancy has increased by 5.5 years from 2000 to 2015, with Africa seeing the largest increase of 9.4 years. The global life expectancy for children born in 2015 was 71.4 years; 73.8 years for females and 69.1 years for males. These expectancies vary by country of birth, but is projected to increase to 77 years by 2050[1,3]. The expected increase is mainly due to improved survival rates in children under 5 years of age [1]. In South Africa, the life expectancy of a person born in 2019 is estimated to be 61.5 years for males and 67.7 years for females [2]. The Western Cape has the highest average life expectancy for males (65.7 years) and females (71.1 years), and it continues to be on an upward trend [2]. In contrast, the Free State province has the lowest average life expectancy (males 54.6 years, females 61.3 years) [2].

The demographic shift to an older population has had social, economic and health implications. Policies addressing housing, employment, social protection and health care are being put in place to meet this ongoing global trend. For instance, some governments are increasing the statutory retirement age and providing flexible employment opportunities for older workers beyond retirement, whilst health care systems are promoting healthy aging and expanding access to quality long term and palliative care [1].

Unique health care burden of geriatric patients

The geriatric patient comes with unique challenges ranging from vagueness of symptoms due to age-related changes in physiology, altered cognitive function (whether due to acute illness or degenerative changes) as well as multiple comorbidities with associated polypharmacy use and the dangers related to it [4,5]. Another challenge is physical disabilities, that may be due to age-associated neuromuscular changes, bone changes or conservatively managed injuries - in many cases this translates to partial or total dependency on family and friends for activities of daily living, medication access and transportation[5]. There is also a general lack of will to seek medical attention due to the often intimidating processes in the medical system and obstacles in transitioning back into the community post discharge [5]. The above factors are interlinked and often exhibit a cause-effect relationship between them, particularly in the emergency centre.

Polypharmacy

Polypharmacy has been most commonly described as the use of five or more medications on a daily basis, with variations on amount and duration of use [6]. Polypharmacy is a common occurrence in geriatric patients as aging is often associated with multiple co-morbidities, each with targeted treatments [7]. A poor understanding by patients or their caregivers of the medicine regimen with regards to correct timing or dosing is a major challenge faced by geriatric patients. Other challenges include the prolonged use of short-term treatment, and the extensive use of non-prescribed medications such as over-the counter drugs and herbal or nutritional supplements [8]. Complications associated with polypharmacy include drug-drug interactions, drug-disease interactions, non-adherence due to pill burden or lack of social support, adverse drug reactions and drug toxicities [9]. Polypharmacy is also associated with a functional decline, cognitive impairment, increased risk of falls and urinary incontinence [9].

Polypharmacy has been significantly associated with patients living with diabetes, heart failure, HIV, joint pain and solid organ transplant due to the number of medications required to control these conditions [7,8]. However, potentially inappropriate prescribing (PIP) is frequent and problematic in geriatric patients. A 2016 study reported a 68.9% prevalence of potentially inappropriate prescribing in South African elderly patients, with the largest number of inappropriate prescriptions by general practitioners [10]. Amongst the most inappropriately prescribed drugs were oestrogen, nonsteroidal anti-inflammatory drugs (NSAIDs), benzodiazepine, amitriptyline and anxiolytics.

Clinicians' knowledge of chronically used drugs and their interaction with newly prescribed drugs is important to optimise patient care. Tools have thus been developed to guide clinicians to detect which prescriptions may or may not be appropriate for their patient; allowing them to review drug regimens

[11]. These tools include the American Geriatric Society Beers criteria [12] and the STOPP/START criteria (Screening Tool of Older People's Prescriptions and Screening Tool to Alert to Right Treatment) [13]. The Beers criteria is a selected list of drugs commonly prescribed to persons >65 years of age. It acts as a reference for clinicians to identify potentially inappropriate medications (PIMs), medications to avoid in older persons, medications that require dose adjustment based on an individual's kidney function. It also provides guidance on which medications require careful monitoring and common drug-drug interactions to avoid. The Beers criteria are frequently updated by a panel of experts to include or exclude drugs based on the latest evidence [12]. Similarly, the STOPP/START criteria review potential adverse effects of prescriptions with the START aspect of the criteria looking at potential prescribing omissions (PPOs) and recommends the addition of certain medications based on co-morbidity or potential side effects of already prescribed medication. The STOPP/START criteria are European guidelines; however, they are more widely used globally than the American Beers criteria. Another variation is the difference in medications listed, with preference to medicine that is used in the specific geographical area [13].

Data on the most appropriate tool is conflicting as one study found the STOPP criteria to be more sensitive than the Beers criteria, while another has described them as being complementary [11][14]. However, it was noted that when START/STOPP criteria were applied at a single time-point during hospitalisation for acute illness, it significantly improved the appropriateness of medicine being prescribed [13]. This effect was carried on for at least 6 months after the intervention [13].

Inappropriate prescribing can also be addressed though regulatory mechanisms; e.g. chronic medications must only be dispensed by primary health care facilities, the creation of central databases for the recording of all of the patient's medications, and having prescriber checkpoints (such as Beers or STOPP/START criteria) for medications relevant to the particular population. However, prescribing practices are poorly evaluated. In a European survey of national medicine regulatory authorities, only one out of sixteen countries had a specific committee to evaluate medicines used by older people and only half had a geriatrician on their medical advisory board [15]. In the Western Cape province of South Africa, prescription data per patient is electronically captured but cannot be accessed from all dispensing facilities. This carries the risk of both over prescribing and duplicating prescriptions.

Adverse drug events (ADEs) are predominantly seen in polypharmacy patients and include injuries caused by drug use at usual doses as well as harm resulting from medication errors [16, 17]. In a Cape Town study done at Groote Schuur hospital, the contribution of ADEs to the burden of care of the elderly patients in the emergency centre were evaluated; ADEs were present in 20% of presenting patients [17]. The drug classes most frequently involved where cardiovascular (34%), anticoagulant (27%), analgesic (19%) and antidiabetic (9%) drugs. Of these, the drugs that were an independent risk

for ADEs were warfarin, Angiotensin converting enzyme (ACE) inhibitors and NSAIDs [17]. Therefore, prescribers must be aware that polypharmacy patients may present solely with complications arising from medication interactions.

Dehydration and hypernatremia

Dehydration, which is a complex condition that results in reduction of total body water, ranges between 20% and 30% in geriatric patients [18]. It can be associated with either insufficient fluid intake or excessive loss of body water [18]. It tends to occur more frequently with increasing age and in patients with more comorbidities. High-risk factors for dehydration in elderly patients are multiple, such as being dependant in all activities of daily living, having to overcome physical barriers to access water, and being deprived (or depriving themselves) of fluids in order to reduce the number of times they need to pass urine. Those living with cognitive or speech impairment may be unable to recognise or communicate their need for water [19]. Reduced thirst perception can also be a result of endocrine or metabolic illnesses or as an adverse effect of certain medications such as psychotropics and anticholinergics [19]. Dehydration is also associated with acute kidney injury [20], of which a rise in serum creatinine by ≥0.5mg/dl was associated with a 6.5-fold increase in risk of death [21]. In a study of elderly dehydrated patients, almost half (47.7%) had acute kidney injury, and of those admitted with dehydration, the 30-day mortality was 17% [20].

Hypernatremia is a frequent electrolyte disturbance seen amongst dehydrated patients and can be associated with symptomatology such as altered mental status, seizures or coma [19]. The prevalence of hypernatremia in South African adults is 1.5% [21]. The mean age being 53 years and the overall in-hospital mortality is 38.7% [22]. A significant problem is that clinical signs are not sensitive in determining the hydration status in geriatric patients due to age-related changes to skin turgor, medication effects on mucosa and loss of muscle mass; however, serum sodium levels seem to be a better indicator and thus recommended for use in assessing the hydration status of elderly patients [23]. Hypernatremia can be both community-acquired or iatrogenic and is associated with poor outcomes. It still carries a significant mortality rate of 52% despite interventions such as admission to intensive care units, selective fluid therapy, careful sodium correction (between 3-4 days as opposed to ≤1 or >4 days), and nephrology consultations [23, 24]. It is thus important to prevent hypernatremia by identifying at-risk patients early (at the time of emergency centre presentation or hospital admission), using judicious fluid therapy where appropriate, and maintaining adequate hydration during hospital stay [25].

Increased fracture risk

The elderly are prone to falls leading to injuries and fractures. Old age is frequently associated with vision impairment, gait instability from lack of muscle strength, neurodegenerative illnesses, and

degenerative or pathological bone changes [26]. Side-effects from medications also increase the risk of falls [26]. Furthermore, patients with neurological deficits from previous strokes had a 2-year fracture rate of 5.7% [27].

The global burden of fractures in people aged 50 years and above was 9 million in 2000[28]. The most frequent fractures occurred in the forearm (1.7 million) and the hip (1.6 million), but hip fractures had the highest morbidity, costs and mortality than all the fractures combined [28]. One study indicated that fractures of the lower trunk were the most frequently seen fracture amongst elderly patients in the emergency centre [29]. It also revealed that two-thirds of all the fractures occurred in women, most likely associated with osteoporotic hormonal changes. Furthermore, most fracture incidents occurred in their homes as opposed to public places and half of the patients required hospital admission for further management [29].

Preventing falls in the elderly is thus important and a multidisciplinary team is required to identify individuals at risk of falling. Physiotherapists could assist with strength training in those with an impaired gait or balance, occupational therapists can address environmental hazards in the home, whereas pharmacists and geriatricians can regularly review medication use to rationalise high risk medication and add supplementation of Vitamin D if needed [30].

Geriatric healthcare needs

Training

The increasing elderly population puts a unique burden on the health care system and specialised training in geriatrics are imperative. However, large workforce deficits occur internationally [31]. The United States had 6000 geriatricians in 2008, with a projected need for at least 4 times that number by 2030 in order to meet sustainable physician-patient ratio [31]. In sub-Sahara Africa, only 31 of 54 countries had trained geriatricians [32]. The future in South Africa is just as worrisome as there are only two geriatric physicians in training in the Western Cape province.

Apathy towards the aging population amongst medical students and physicians alike was noted [33]. The main concern of physicians was the institutional expectation of the same speed and efficiency when dealing with elderly patients as with younger aged patients [33]. The above were perceived as difficult to achieve due to the complexity of diseases with underlying co-morbidities, polypharmacy use and the vagueness of their symptoms, as well as due to altered physiological responses and cognitive impairment [5]. Only 15% of South African physicians viewed working with older patients positively [32]. Culture, religion, institutional and personal factors influenced their attitudes towards older patients, and only a small number had considered a career in geriatrics [34]. On the other hand, programs are being implemented to equip non-geriatrician specialities with tools necessary to

strengthen and enhance knowledge regarding care of the elderly [32, 35], an example of such is the Geriatrics Education Team (GET) model which looked at curriculum shortcomings amongst physicians in training throughout various specialities [36]. The model focuses on integrating geriatric principles relevant to the particular speciality into their training programme in a sustainable manner [36]. A similar program was created for non-geriatricians who held key educational positions such as assistant deans, head of departments, and clerkship and residency directors. These leaders received special training and resources to develop geriatric educational experiences within their own specialities, such as electives in care of elderly patients in the emergency centre as well as integrating palliative care within their programs [35]. More countries are also establishing formal geriatric fellowship programs with some African countries using a collaborative approach with western countries that have already established programs in order to develop their own [32]. Locally, geriatrics was established as a subspecialty at the University of Cape Town in 1997[37], whilst Stellenbosch University offers it as a short course within the Department of Family Medicine [38].

Adaptations of health care services

Home care models

As some elderly patients prefer being treated at home, health care models were subsequently developed that offered emergency care by multidisciplinary teams to patients in their own homes; the ASSET model (Age Specialist Services Emergency Team) being an example [39]. The overarching aim of these health care models are to reduce hospital admissions and to lessen the anxiety and effort associated with hospital visits [39]. It was also noted to be a relatively safe intervention, at 30 days 68% had continued support at home, 3% were still in hospital, 24% were readmitted to hospital and 5% died [39].

Geriatric-friendly emergency centres

Aging is associated with numerous frailties including vision and hearing impairment, forgetfulness and memory loss, speech impairment or loss, gait imbalance or dependence on mobility aids, as well as loss of independence in activities of daily living. Some countries have built geriatric-specific emergency centres whose physical designs are aligned to cater for these geriatric frailties. Examples of geriatric-friendly features in the emergency centre are given on Box 1[40].

Non-slip floors
Wheelchair access paths and railings against walls for easier and safer mobility
Cubicles for privacy
Adjustable lighting in keeping with circadian sleep cycles
Less visual and auditory stimulants to reduce the risk of delirium
Beds fitted with pressure-reducing mattresses to avoid skin breakdown
Bigger and bolder signage for ease of communication
Conducive ambient temperatures

Box 1 Geriatric-friendly features in emergency centres

Designated staff can also be used to make to ensure that an emergency centre is geriatric-friendly [41]. As an example, a senior nurse who is specialised in geriatrics is assigned to identify and streamline elderly patients at the point of entry in the emergency centre. They essentially act as patient advocates by fast-tracking their movement through the emergency centre starting from being triaged, to being seen by the emergency centre physician. The nurse can also ensure that investigations are carried out in a timely manner and that treatment is commenced early and continued till the time of admission or discharge [41].

Geriatric-specific triage tools

The emergency severity index (ESI) is a triage tool that has been used in different populations including geriatrics. It categorises patients into five severity groups; 1 being the most severe category and 5 being the least severe category [42]. Its parameters include patient acuity, vital signs, and the anticipated number of resources required for a patient up to disposition. Resource categories include blood product administration, mechanical ventilation, and laboratory testing amongst a few. It accurately predicts hospitalisation, emergency centre length of stay and resource utilisation. The triage categorization is also strongly correlated to 1-year survival after the index emergency centre visit [42].

Trauma in geriatric patients tends to be under-triaged when determining which patients require specialist trauma centre care when using standard triage tools [43]. The Ohio triage tool (an emergency medical services triage tool) was specifically adapted for geriatric patients in order to identify those requiring specialised trauma care (Table 1) [43]. The new criteria led to a 14% increase

in patients qualifying for specialist trauma care, but was not associated with significant differences in mortality [44].

Table 1. Differences between Ohio's 2009 geriatric trauma triage criteria and adult trauma triage criteria for emergency medical services

Geriatric Triage Criteria (≥70 years)	Corresponding adult triage criteria (16 – 69 years)
Physiological	
Systolic blood pressure less than 100 mm Hg, or absent radial pulse with carotid pulse present	Systolic blood pressure less than 90 mm Hg, or absent radial pulse with carotid pulse present
GCS score ≤14 in trauma patient with a known or suspected traumatic brain injury	GCS score ≤13
Anatomic	
Fracture of 1 proximal long bone sustained from motor vehicle crash	Fractures of 2 or more proximal long bones
Injury sustained in 2 or more body regions	No corresponding adult criteria
Cause of Injury	
Pedestrian struck by motor vehicle	No corresponding adult criteria
Fall from any height, including standing falls, with evidence of a traumatic brain injury	No corresponding adult criteria

GCS: Glasgow Coma Scale

The South African Triage Scale (SATS) is used in South African emergency centres. It consists of three age-related versions (neonatal, paediatric, and adult), but does not include geriatric-specific cut-offs [45]. The effect of this has not been tested, but is likely to under-triage the elderly patient. In order to address this, some emergency centres utilise an electronic system that flags elderly patients by displaying their age in bold and in a different colour despite their triage score in order to promote early attendance by physicians (personal communication: Dr. M. Parak, February 2020).

Comprehensive geriatric assessment

The geriatric patient's needs are often not only medical related but also mental, psychological [46], social and functional [47]. This becomes evident in repeat emergency centre visits. Risk factors for multiple emergency centre visits are: frail patients, improper management of chronic diseases, multiple medications used or their side effects, previous difficulties in discharging a patient and missed hospital appointments [48]. Most of the reasons for frequently attending the emergency centre relates to lack of social and financial support [49].

Comprehensive geriatric assessment (CGA) is a patient-centred method of managing frail geriatric patients. The aim of this multidimensional approach to care is to optimise the medical, social, psychological and functional aspects of the patient's wellbeing [50]. It involves shared decision making

amongst the patient, their family or caregiver and the CGA team in order to come up with a comprehensive care plan. The CGA team is typically comprised of a specialised geriatrician doctor and nurse, a junior doctor, a physiotherapist, an occupational therapist, a pharmacist and a social worker. The CGA enlists a number of approaches and specific questions in order to address geriatric-associated conditions. A full assessment may take anywhere between 2 hours to a few days with respect to the patient's ability to tolerate the assessment [50]. Traditionally CGAs were done in primary care facilities, but assessments are now being done in emergency centres as well, as it is beneficial to the patient and feasible in the acute care setting [51, 53]. Implementation of CGAs has led to reduced emergency centre length of stay, reduced hospital admissions, and reduced hospital length of stay without increasing mortality or same cause re-presentations [41].

Conclusion

The undeniable growth of the geriatric population worldwide comes with the necessity for their needs to be appreciated by healthcare workers, especially in emergency centres. Strategic measures to ease the barriers to flow of geriatric patients through the Emergency centre are being enforced in some countries, such as, alternative triage protocols for geriatric patients, geriatric-specific nursing staff and geriatric EC teams. However, other countries still lack systems to identify and overcome these barriers. To our knowledge no studies have been done to look at the how the South African ECS are addressing geriatric patients. Studies have been done about the geriatric patient's outcomes during and post EC visits but there is no knowledge of what the outcomes of the geriatric patients who visit South African ECs are. Internationally ECs are embracing a holistic approach in the care and management of the geriatric patient both by enhancing their physical environment to accommodate the frailties of the elderly, as well as optimising each visit to comprehensively address their key needs as a step towards encouraging quality geriatric healthcare. There is little knowledge of what South African ECs are doing to encourage such an approach of inclusiveness of the geriatric patient in the emergency care structure. Furthermore, involvement of the various specialities and medical students in geriatric education and care to help reduce apathy towards this marginalised population and contribute to the much needed knowledge gaps currently seen is being done in a lot of countries whereas no known research is available on how South African is addressing this knowledge gap amongst its clinicians.

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Part B: Manuscript in article format

(Prepared for African Journal of Emergency Medicine)

Title page

The characteristics of geriatric patients managed within the resuscitation unit of a district-level emergency centre in Cape Town

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Word count: 2563

Number of figures/tables: 5

Abstract

Introduction

The world's population is ageing and this trend is also seen in South Africa. This increase will invariably affect acute care services. The geriatric population attending emergency centres have not been described in the South African setting. The objective was to describe the characteristics of geriatric patients presenting to the resuscitation unit of a district-level hospital in Cape Town.

Methods

All patients (≥65 years) managed within the resuscitation unit of Khayelitsha Hospital over an 8-month period (01 January - 30 August 2018) were retrospective analysed. Data were collected from the Khayelitsha Hospital Emergency Centre database and by means of a retrospective chart review. Summary statistics are presented of all variables.

Results

A total of 225 patients were analysed. The median age was 71.1 years, 148 (65.8%) were female and all were residing in their family home. The majority (n=162, 72%) presented outside office hours, 124 (55.1%) arrived by ambulance, and 94 (41.8%) had presented to the emergency centre within the previous year. Only half the patients (n=114, 50.7%) were triaged as very urgent or higher. Most patients (n=169, 75.1%) were admitted by in-hospital services and the in-hospital mortality was 21.8% (n=49). Diseases related to the circulatory system (n=54, 24.0%) were the most frequent primary diagnosis and acute kidney injury were the most frequent secondary diagnosis (n=101, 44.9%). The most common comorbidities were hypertension (n=176, 78.2%) and diabetes (n=110, 48.9%), and 99 (44%) had three or more comorbidities. Polypharmacy (≥5 medications) occurred in 100 (44.4%) patients with 114 (50.7%) using medications from three or more different classes. The prevalence of hypernatremia was 2.6 % and for hyponatremia 54.4%.

Conclusion

Geriatric patients managed within the resuscitation unit of a district-level hospital had a high return rate, multiple co-morbidities and a high prevalence of polypharmacy and hyponatraemia.

Introduction

The world's population is ageing. The global average life expectancy has increased by 5.5 years between 2000 and 2015, with the largest increase (9.4 years) seen in Africa. The global life expectancy for children born in 2015 was 71.4 years, and although it varies by country, is projected to increase to 77 years by 2050 [1,2]. In South Africa, the life expectancy of a person born in 2019 is estimated to be 61.5 years for males and 67.7 years for females [3]. The Western Cape province has the highest average life expectancy for males (65.7 years) and females (71.1 years), and currently is home to an estimated 447 000 elders (6.5% of the province's population) [3].

Geriatric patients often present with unique and complex symptomatology that may be daunting for many clinicians [4]. The clinical challenges include vagueness of symptoms, altered cognitive function, and multiple comorbidities. Complications often arise from polypharmacy due to drug-drug interactions, drug-disease interactions, adverse drug effects and toxicities [5]. Geriatric patients are also at high risk of dehydration with associated hypernatremia, which are often complicated by acute kidney injury and a subsequent increased risk of death [6,7] The elderly are also prone to falls leading to injuries and fractures. This may be related to musculoskeletal disorders (e.g. lack of muscle strength, osteoporotic age-related changes), neurological disorders (e.g. previous stroke, loss of proprioception), visual disturbances and even side-effects from polypharmacy [8]. The long-term management of geriatric patients are further complicated by the dependency on family and friends, a general lack of will to seek medical attention due to the often intimidating processes in the medical system, and obstacles in transitioning back into the community post discharge [9,10].

The challenges that accompany geriatric patients cannot be ignored and reconsideration of how to manage acutely ill geriatric patients is ongoing worldwide. Some centres have created Comprehensive Geriatric Assessment (CGA) units to focus on the medical, psychological and social aspects of care, and include multi-disciplinary emergency center-based teams that consists of physiotherapists, occupational therapists, social workers, community nurses, junior physicians and experienced geriatricians [11].

The proportion of geriatric patients presenting to emergency centres in Sub-Saharan Africa has increased [12], and emergency medical systems must adapt to ensure the provision of adequate acute care. Limited data is available that describe geriatric patients presenting to emergency centres in South Africa, and no data exists regarding geriatric patients living in very poor communites where many are staying in informal dwellings with limited access to water and electricity. Identifying patterns of acute care utilization specific to the geriatric population could be key to ensure adequate and timely access to health care and to improve health outcomes. The aim of the study was to describe the

characteristics of geriatric patients (≥65 years) presenting to the emergency centre of a district-level hospital in Cape Town. As secondary objectives, the study determined the process times, the prevalence of hypernatremia, and the burden of polypharmacy in the geriatric population.

Methods

A retrospective analysis of a prospectively collected observational database was conducted. This was supplemented by a chart review to limit missing data and to include additional variables.

Khayelitsha Hospital is a 300-bed district-level hospital situated about 34 kilometres from Cape Town's city centre. It serves a health district of approximately 500 000, with a population density of 10 120 persons/km^2 [13]. The population consist of 98.6% Black African and 1.6% are elderly (>65 years) [13]. Khayelitsha health district covers one of the largest informal housing settlements with high levels of unemployment and extremely low-income households. Khayelitsha Hospital's emergency centre is larger than that of a standard district hospital in the Western Cape [15,16], and serves about 3 500 patients per month; of which 20% are high acuity geriatric patients [14]. A five-bed (including one paediatric cot) resuscitation unit is incorporated within the emergency centre. Patients are admitted to the resuscitation unit based on clinician discretion, as well as a high acuity score according to the South African Triage Scale [15].

The electronic Khayelitsha Hospital Emergency Centre database is a prospectively collected observational database capturing all patients managed within the resuscitation unit since 1 November 2014 [14]. Data are captured electronically, are coded and stored onto a password protected server. A decoding sheet is separately stored.

All geriatric patients (≥65 years) who were managed within the resuscitation unit of Khayelitsha Hospital over an 8-month period (01 January - 30 August 2018) were eligible for inclusion. Patients with missing folders or incorrect folder numbers were excluded.

Data were collected by a single investigator after obtaining a decoded cleaned extract of the database (with all non-geriatric cases removed). Missing data and new variables were incorporated by reviewing patients' electronic clinical records. A standardised data collection form was used (supplementary material A). Data were not verified due to a lack of resources.

Patient acuity was measured using the South African Triage Scale, which categorises patients as Emergency (Red), Very urgent (Orange), Urgent (Yellow), and Non-urgent (Green) [15]. Diseases were categorised based on the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10). Polypharmacy was defined as the concurrent use of ≥5 medications by a patient. Hypernatremia was defined as a serum sodium level >145 mmol/L and hyponatremia as

a serum sodium level ≤135 mmol/L. All-cause in-hospital mortality included patients that died of any cause since arriving to the emergency centre.

Summary statistics were used to describe all variables. Categorical data was summarised using frequency counts or percentages, and distributions of variables were presented as two-way tables or bar charts. Medians were used as the measures of central tendency for continuous responses and quartiles as indicators of spread. Analyses were done using SPSS Statistics for Windows, Version 26.0 (IBM Corp. Released 2019. Armonk, NY: IBM Corp.). Incomplete data points were excluded from analyses.

Results

A total of 3657 patients were managed within the resuscitation unit over the study period, of which 248 (6.8%) patients were 65 years of age or older. Twenty-three patients were excluded (dead on arrival n=10, incorrect folder number n=13) and 225 patients were analysed. The median (25^{th} - 75^{th} percentile) age at presentation was 71.1 (68.2 - 77.3) years (male 72.45 years, female 70.34 years). Patients were mostly female (n=148, 65.8%) and all were residing in their family home (missing n=1, 0.4%) (Table 1). The majority of patients presented outside office hours (n=162, 72%) (supplementary material B). Ninety-four (41.8%) patients visited the emergency centre within the previous year, of whom 24 (10.7%) presented three times or more (maximum visits = 7). All patients transferred to facilities capable of providing a higher level of care had medical (non-traumatic) conditions. The in-hospital mortality rate was 21.8% (n=49), of whom 14 died within the resuscitation unit.

Table 1. Demographics and characteristics of geriatric patients managed within the resuscitation unit of Khayelitsha Hospital over an 8-month period

	n (%) unless otherwise specified
Gender	
Male	77 (34.2)
Female	148 (65.8)
Age, median (Q1-Q3)[a]	
Years	71.1 (68.2 - 77.3)
Residence	
Home	224 (99.6)
Unknown	1 (0.4)
Patient acuity[b]	
Emergency (Red)	47 (20.9)
Very urgent (Orange)	67 (29.8)
Urgent (Yellow)	74 (32.9)
Non-urgent (Green)	37 (16.4)
Mode of transport	
Emergency medical services	124 (55.1)
Private	49 (21.8)
Unknown	52 (23.1)
Admission category	
Medical	207 (92.0)
Trauma	18 (8.0)
Mechanism of injury	
Falls	12 (66.7)
Other causes of trauma	6 (33.3)
Disposition from resuscitation unit	
Discharged directly home	9 (4.0)
Managed by emergency centre staff outside resuscitation unit	30 (13.3)
Referred to in-hospital services within Khayelitsha Hospital	146 (64.9)
Referred to tertiary facilities	23 (10.2)
Died in resuscitation unit	14 (6.2)
Unknown	3 (1.3)
Time intervals, median (Q1-Q3)[a] [maximum]	
Time to being triaged (minutes)	5 (1 - 10) [186]
Time to resuscitation unit (hours)	0.8 (0.3 – 4.3) [60]
Time to physician consult (hours)	1.3 (0.5 - 3.3) [25]
Length of stay, median (Q1-Q3)[a] [maximum]	
In resuscitation unit (hours)	6.4 (3.4 - 12.5) [42.8]
In hospital (days)	2.4 (0.7 - 5.4) [29.5]

[a] 25th – 75th percentile; [b] According to the South African Triage Scale;

Diseases related to the circulatory system (n=54, 24.0%) were the most frequent primary diagnosis followed by endocrine, nutritional and metabolic diseases (n=47, 20.9%), diseases of the respiratory system (n=31, 13.8%), and diseases of the nervous system (n=29, 12.9%) (Table 2). The top five circulatory-related diseases were hypertension, ischemic heart disease, congestive cardiac failure, atrial fibrillation and hypertensive heart disease. Most deaths occurred in patients with diseases

related to the circulatory system (n=12, 24.5%). Diseases of the genitourinary system (all acute kidney injury) were the most frequent secondary diagnosis (n=101, 44.9%), and was the secondary system with the most deaths (n=25, 51.0%) (Table 2).

Table 2 Diagnostic categories of geriatric patients admitted to the resuscitation unit of Khayelitsha Hospital over an 8-month period

ICD-10[a] code	**Primary diagnosis n (%)**	**Died in hospital n (%)**	**Secondary diagnosis n (%)**	**Died in hospital n (%)**
I Certain infectious and parasitic diseases	17 (7.6)	5 (10.2)	2 (0.9)	0 (0)
II Neoplasms	7 (3.1)	2 (4.1)	1 (0.4)	0 (0)
IV Endocrine, nutritional and metabolic diseases	47 (20.9)	9 (18.4)	3 (1.3)	2 (4.1)
V Mental and behavioural disorders	0 (0.0)	0 (0)	5 (2.2)	1 (2.0)
VI Diseases of the nervous system	29 (12.9)	9 (18.4)	0 (0.0)	0 (0)
IX Diseases of the circulatory system	54 (24.0)	12 (24.5)	6 (2.7)	0 (0)
X Diseases of the respiratory system	31 (13.8)	7 (14.3)	12 (5.3)	2 (4.1)
XI Diseases of the digestive system	6 (2.7)	2 (4.1)	1 (0.4)	0 (0)
XII Diseases of the skin and subcutaneous tissue	8 (3.6)	2 (4.1)	1 (0.4)	1 (2.0)
XIII Diseases of the musculoskeletal system and connective tissue	1 (0.4)	0 (0)	0 (0.0)	0 (0)
XIV Diseases of the genitourinary system	3 (1.3)	0 (0)	101 (44.9)	25 (51.0)
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	1 (0.4)	0 (0)	0 (0.0)	0 (0.0)
XIX Injury, poisoning and certain other consequences of external causes	19 (8.4)	0 (0)	0 (0.0)	0 (0)
Unknown	2 (0.9)	1 (2.0)	0 (0.0)	0 (0)
None	0 (0.0)	0 (0)	93 (41.3)	18 (36.7)
Total	**225 (100)**	**49 (100)**	**225 (100)**	**49 (100)**

[a] International Statistical Classification of Diseases and Related Health Problems 10th Revision

The most common co-morbidities were hypertension (n=176, 78.2%) and diabetes (n=110, 48.9%) (Table 3). Eighteen patients (8.0%) had no comorbidities, 40 (17.8%) had one comorbidity, 68 (30.2%) had two comorbidities, and 99 (44%) had three or more comorbidities. Six patients (2.7%) had six co-morbidities each. Hypertension and diabetes were also the most frequent comorbidity among those that died, 36 (73.5%) and 17 (34.7%) respectively (Table 3).

Table 3. Co-morbidities of geriatric patients admitted to the resuscitation unit of Khayelitsha Hospital over an 8-month period

Co-morbidity	**All n (%)**	**Died in hospital n (%)**
Hypertension	176 (78.2)	36 (73.4)
Diabetes	110 (48.9)	17 (34.7)
Chronic kidney disease	34 (15.1)	5 (10.2)
Ischemic heart disease	24 (10.7)	3 (6.1)
Cerebrovascular accident	24 (10.7)	8 (16.3)
Cancer	13 (5.8)	4 (8.2)
Chronic obstructive pulmonary disease	11 (4.9)	1 (2.0)
Human immunodeficiency virus	10 (4.4)	2 (4.1)
Dementia	6 (2.7)	1 (2.0)
Other	80 (35.6)	15 (30.6)

Polypharmacy occurred in 100 (44.4%) patients, with a maximum of 13 drugs being taken by one patient. Forty-one patients (18.2%) did not use any chronic medication, while 24 (10.7%) used one medicine, 15 (6.7%) used two medications, 20 (8.9%) used three medications and 25 (11.1%) used four medications. Forty-one patients (18.2%) used medications from one class, 29 (12.9%) from two classes, 41 (18.2%) from three classes and 73 (32.5%) from 4 or more different classes. Amongst the patients on anti-hypertensive medication, 81.3% (117/144) were taking two or more different anti-hypertensive drugs (Table 4). The most frequent drug taken per class was a diuretic (121/144, 84.0%), a biguanide (64/83, 77.1%), aspirin (73/80, 91.3%), and paracetamol (45/52, 86.5%) (supplementary material C).

Table 4. Number of medicines by class used by geriatric patients managed within the resuscitation unit of Khayelitsha Hospital

Number of drugs per class	Anti-hypertensive n (%)	Anti-diabetic n (%)	Anti-coagulation and anti-platelet n (%)	Lipid-lowering (statin) n (%)	Analgesia n (%)	Other n (%)
None	81 (36)	142 (63.1)	145 (64.4)	151 (67.1)	173 (76.9)	139 (61.8)
One	27 (12)	50 (22.2)	71 (31.6)	74 (32.9)	30 (13.3)	48 (21.3)
Two	49 (21.8)	31 (13.8)	9 (4.0)	0 (0.0.)	21 (9.3)	18 (8)
Three	46 (20.4)	2 (0.9)	0 (0.0)	0 (0.0)	1 (0.4)	10 (4.4)
Four	21 (9.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (1.3)
Five or more	1 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7 (3.1)

In total, 140 (62.2%) patients received intravenous fluids, 100 (44.4%) received antibiotics, and 23 (10.2%) were treated with non-invasive positive pressure ventilation. Only 2 (0.9%) patients were intubated and ventilated.

The results of laboratory tests performed on arrival to the resuscitation unit are presented in Table 5. Hypernatremia was present in 6 (2.6%) patients, while hyponatremia was evident in 122 (54.4%) patients.

Table 5. Laboratory test results of geriatric patients managed within the resuscitation unit of Khayelitsha Hospital

	n	Median (Q1-Q3[a]) [Maximum]	Reference range
Sodium (mmol/L)	207	133 (129-137) [147]	136 - 145
Potassium (mmol/L)	203	4.1 (3.7-14.8) [8.3]	3.5 – 5.1
Urea (mmol/L	207	9.4 (5.4-17.6) [55]	2.1 - 7.1
Creatinine (umol/L)	211	118 (74-197) [1206]	49 – 90
White cell count	208	10.2 (7.29-14.48) [53.3]	3.9 – 12.6
Haemoglobin (g/dL)	205	11.9 (10.1-13.3) [18.1]	11.6 – 16.4
Mean corpuscular volume (fL)	205	89.9 (85.0-94.0) [111.7]	78.9 – 98.5

[a] 25^{th} – 75^{th} percentile

Discussion

This study describes the characteristics of geriatric patients managed within the resuscitation unit of a district-level hospital. Two thirds of the patients were female, 92% of patients had at least one co-morbidity, and 42% had visited the emergency centre within the previous year. Despite half of the patients being triaged as low acuity, the majority of patients were admitted to in-hospital specialist services and the all-cause in-hospital mortality was 22%. Both polypharmacy (44%) and hyponatraemia (54%) occurred frequently. Acute kidney failure was a major contributor to mortality.

A substantial number of patients (41.8%) visited the emergency centre within the past year and is similar to Canadian study (43.9%) [16]. However, in the latter study the population sample was derived from tertiary and community-level hospitals and based on stable (non-critical) patients that presented during day-time on weekdays. Similar to our study, females and those living at home frequently revisited the emergency centre, as did those with concomitant diabetes and heart disease. The study also indicated that people living with depression had multiple return visits; this could have been missed in our study as it is not routinely assessed in the emergency centre. Other possibilities for return visits are incomprehensive discharge plans, unimplemented palliative protocols, misuse of the emergency care system or inadequate primary and community care systems [16,17].

Only half the patients (50.7%) managed in the resuscitation unit were triaged as needing very urgent or emergent care (Table 1). District-level healthcare facilities in South Africa do not have high care units and the resuscitation unit is often the only non-theatre area where patients can be monitored continuously. It is thus a limited, highly sought-after resource and its inappropriate use needs to be identified and rectified. The South African Triage Scale does not incorporate advanced age and it might well be under triaging geriatric patients. Similarly, other triage tools also don't incorporate advance age [18,19], but a pre-hospital triage tool for geriatric trauma patients found that a substantial number of patients (58%) actually do qualify to be treated at a specialised trauma centre [20]. A small decrease (0.5%) in mortality was witnessed in mildly injured patients, but mortality did not change significantly in severely injured patients [20]. However, the limited resource might be better utilised by younger patients with a longer life expectancy that could potentially still contribute economically to society. An appropriate balance is needed, and it might be worthwhile to further investigate the triaging of geriatric patients taking into account the principles of distributive justice, especially in resource constrained environments.

Patients stayed in the resuscitation unit for approximately six hours with the longest duration of stay almost two days. This is concerning as slow patient turnover could reflect inefficiencies in the hospital system such as delays with support services (radiology and laboratory), access block, tertiary transfer

difficulties as well as an imbalance of staff to patient ratios [21–23]. More than half the patients that required in-hospital admission only stayed around two and a half days. This questions the necessity of these admissions as opposed to whether the patients could have benefited from a comprehensive geriatric assessment in the emergency centre before being discharged home [11].

Polypharmacy occurred frequently and mostly comprised of anti-hypertension and anti-diabetic medications. This is expected, as the South African National Health and Nutrition Survey (SANHAES-1) reported an increase in the prevalence of non-communicable diseases in South Africa, mainly hypertension (16.5%), diabetes (5%) [24]. A previous South African study indicated that polypharmacy was associated with adverse drug events in 20% of geriatric presentations [25]. The frequently implicated drug classes were cardiovascular (34%), anticoagulant (27%), analgesics (19%), and anti-diabetic (9%) [25]. The study further indicated that over-the-counter medications and traditional medicines were used frequently and also contributed to polypharmacy [25]. The lack of an effective system makes it difficult for physicians to determine which medications patients are using and whether they are appropriate; thereby increasing the risk of over-prescribing. Inappropriate prescriptions in the South African geriatric population had a 13% prevalence, and mainly related to oestrogen, amitriptyline, benzodiazepines, nonsteroidal anti-inflammatory drugs (NSAIDs) and proton-pump inhibitors (PPIs) [26]. A country-specific guideline, similar to the internationally used BEERS list or STOPP/START criteria [27,28], would be helpful to prevent inappropriate prescribing in the elderly.

Hypernatremia occurred in 2.6% (n=6) of patients, which is less than the 3.5% prevalence previously described in the geriatric population [29,30] but higher than the 1.5% prevalence in the general South African population [31]. Similar to our findings, hypernatremia was associated with hypovolemia and sepsis [29–31]. Hyponatremia occurred in 54.5% (n=122) of patients and is much higher than previously published data from international studies where the prevalence of hypernatremia ranged between 17% and 34% in geriatric patients managed in acute care settings [32–34]. Common factors associated with hyponatremia are age-related impaired salt-water balance, chronic thiazide diuretic use, idiopathic syndrome of inappropriate antidiuretic hormone and endocrinopathies [35]. We did not attempt to identify the exact cause of the high prevalence of hyponatremia in our setting, and further studies are needed to better understand and potentially address this finding.

Study limitations

Several factors may have influenced the results of this study. The strengths of the study include the use of a single trained abstractor (not blinded to the study objective), a standardised data collection sheet, and well defined variables. The use of a second reviewer and assessing the interrater agreement would have improved the validity of the results; this was unfortunately not feasible due to limited

resources. Diagnostic codes (ICD-10) were used as a surrogate measure of disease and might not be entirely accurate. We did not attempt to quantify any potential misclassifications and subsequent bias that could have resulted from either the validity of the diagnosis made or the association between the diagnostic code and the actual diagnosis. Chronic medication data were only taken from the patients' hospital records and did not include the records from community healthcare centres where patients collect their chronic medication; it is thus possible that the frequency of polypharmacy could be even higher than recorded. Included patients were limited to the resuscitation section of the emergency centre and might not be reflective of the emergency centre as a whole. Lastly, the study was done in a single emergency centre with a unique demographic profile and the results might not be generalizable to different settings.

Conclusion

Geriatric patients managed within the resuscitation unit of a district-level hospital had a high return rate, multiple co-morbidities and a high prevalence of polypharmacy and hyponatraemia. The persistent growth in the geriatric population and their unique age-related complications will continue to increase the burden on the emergency care system. Geriatric-friendly processes should be considered to ensure that geriatric patients are appropriately triaged and managed in the acute care setting, while systems need to be put in place to limit polypharmacy and over-prescribing. Comprehensive geriatric management plans might decrease frequent re-admission to the emergency centre. Further studies are needed to identify the cause and impact of the high level of hyponatremia.

Dissemination of results

Results from this study was shared with the management team at Khayelitsha Hospital

Authors' contribution

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content:

NS contributed 60%, DJvH 35%; and EE contributed 5%.

All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflicts of interest.

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Supplementary material A

Khayelitsha Geriatrics Study: Data collection sheet

Date of Birth: yy / mm / dd

Gender: ☐ M ☐ F

Place of residence: ☐ Family Home ☐ Nursing Home ☐ Hospice/Rehabilitation centre

Arrival at hospital: Date yy / mm / dd Time _____

Arrival in resuscitation: Date yy / mm / dd Time _____

Triage: Date yy / mm / dd Time _____

Seen by doctor: Date yy / mm / dd Time _____

Number of EC visits in past year: _____

Transport used: ☐ Ambulance ☐ Private ☐ Unknown

Patient acuity (South African Triage Scale): ☐ Green ☐ Yellow ☐ Orange ☐ Red

Admission category: ☐ Medical ☐ Trauma

Mechanism of injury: ☐ Fall ☐ MVA/PVA ☐ Other:_____

Comorbidities: ☐ Diabetes

☐ Hypertension

☐ Ischaemic heart disease

☐ HIV

☐ Chronic kidney disease

☐ Cancer

☐ CVA

☐ Dementia

☐ COPD

☐ Other:_____

Prescribed medications:

Anti-hypertensive: ☐ Ca^{2+}-channel blocker ☐ β-blocker ☐ Diuretics ☐ ACE-I/Angiotensin

Anti-diabetic: ☐ Insulin ☐ Biguanide ☐ Sulfonylurea

Anti-coagulation: ☐ Warfarin ☐ Clopidrogel ☐ Aspirin

Statins: ☐ Yes

Analgesia: ☐ NSAIDs ☐ Opioid ☐ Paracetamol

Other medications: Class:_____ Name:_____

Class:_____ Name:_____

Class:_____ Name:_____

Class:_____ Name:_____

Class:_____ Name:_____

Primary diagnosis (ICD-10 category):

I Certain infectious and parasitic diseases	
II Neoplasms	
III Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	
IV Endocrine, nutritional and metabolic diseases	
V Mental and behavioural disorders	
VI Diseases of the nervous system	
VII Diseases of the eye and adnexa	
VIII Diseases of the ear and mastoid process	
IX Diseases of the circulatory system	
X Diseases of the respiratory system	
XI Diseases of the digestive system	
XII Diseases of the skin and subcutaneous tissue	
XIII Diseases of the musculoskeletal system and connective tissue	
XIV Diseases of the genitourinary system	
XV Pregnancy, childbirth and the puerperium	
XVI Certain conditions originating in the perinatal period	
XVII Congenital malformations, deformations and chromosomal abnormalities	
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	
XIX Injury, poisoning and certain other consequences of external causes	
XX External causes of morbidity and mortality	
XXI Factors influencing health status and contact with health services	
XXII Codes for special purposes	

Secondary diagnosis (ICD-10 category):

I Certain infectious and parasitic diseases	
II Neoplasms	
III Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	
IV Endocrine, nutritional and metabolic diseases	
V Mental and behavioural disorders	
VI Diseases of the nervous system	
VII Diseases of the eye and adnexa	
VIII Diseases of the ear and mastoid process	
IX Diseases of the circulatory system	
X Diseases of the respiratory system	
XI Diseases of the digestive system	
XII Diseases of the skin and subcutaneous tissue	
XIII Diseases of the musculoskeletal system and connective tissue	
XIV Diseases of the genitourinary system	
XV Pregnancy, childbirth and the puerperium	
XVI Certain conditions originating in the perinatal period	
XVII Congenital malformations, deformations and chromosomal abnormalities	
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	
XIX Injury, poisoning and certain other consequences of external causes	
XX External causes of morbidity and mortality	
XXI Factors influencing health status and contact with health services	
XXII Codes for special purposes	

Interventions received:

□ IV fluids □ Antibiotics □ Intubation □ NIPPV □

Laboratory results:

Sodium: _____ Potassium: _____ Urea: _____ Creatinine: _____

White cell count: _____ Haemoglobin: _____ MCV: _____

Disposition from resuscitation:

□ Home □ EC □ KDH specialities □ Tertiary □ Died □ Unknown

Died while in hospital: □ Yes □ No

Supplementary material B

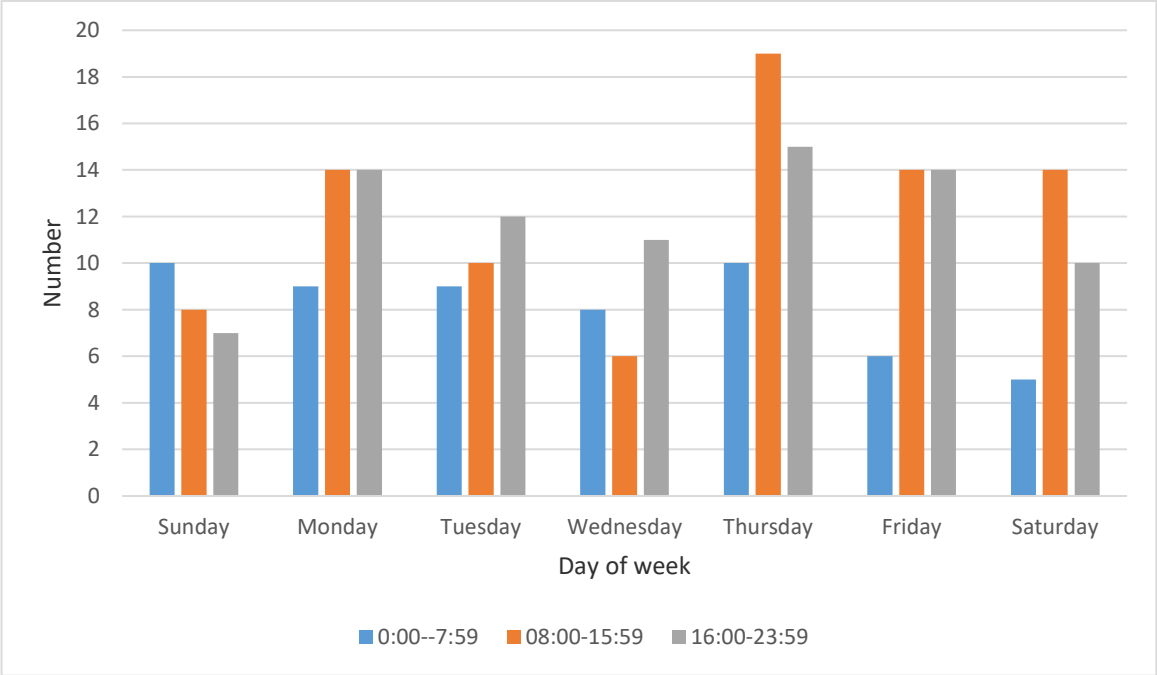

Figure. Day and time of presentation of geriatric patients to the resuscitation unit of Khayelitsha Hospital

Supplementary material C

Table. Individual drugs per class used by geriatric patients managed within the resuscitation unit of Khayelitsha Hospital

	n (%)
Anti-hypertensive (n=144)	
Calcium channel blockers	65 (45.1)
Beta-blockers	39 (27.1)
ACE-I[a]/Angiotensin receptor blocker	106 (73.6)
Diuretics	121 (84.0)
Anti-diabetic (n=83)	
Insulin	38 (45.8)
Sulfonylureas	16 (19.3)
Biguanides	64 (77.1)
Anti-coagulation & anti-platelets (n=80)	
Warfarin	8 (10.0)
Clopidogrel	8 (10.0)
Aspirin	73 (91.3)
Analgesia (n=52)	
Paracetamol	45 (86.5)
NSAIDS[b]	3 (5.8)
Opioids	27 (51.9)

[a] Angiotensin-converting enzyme inhibitor; [b] Non-steroidal anti-inflammatory drugs

Part C: Appendices

Appendix A. Approved study protocol

Characteristics of geriatric patients presenting to a district-level emergency centre in Cape Town

Principal Investigator: Dr DJ Van Hoving

Division of Emergency Medicine

University of Stellenbosch

Table of Contents

INTRODUCTION

Background

South Africa's population is getting older. The Gauteng province has the largest percentage (29%) of geriatric persons (>60 years) in South Africa[1]. In the Western Cape, the total number of geriatric persons are estimated at 447000, translating into 6.5% of the province's population[1]. The Western Cape have the highest average life expectancy for males (65.7 years) and females (71.1 years), and continues to be on an upward trend.[1] In contrast, the Free State have the lowest average life expectancy (males 54.6 years, females 61.3 years)[1].

Geriatric patients are undeniably a significant proportion of emergency centre patients; however the complexity of geriatric care often tends to be a daunting task for many clinicians[2]. The geriatric patient comes with unique challenges ranging from vagueness of symptoms, altered cognitive function, multi-comorbidities, physical disabilities, polypharmacy use, physiological changes, dependency on family and friends, general will or lack thereof to seek medical attention and obstacles in transitioning back into the community[3,4]. These challenges cannot be ignored and reconsideration of how to manage acutely ill geriatric patients is ongoing worldwide. Some centres have adopted multi-disciplinary teams working in the emergency centre (consisting of physiotherapy, occupational therapy, social worker, community nurse, junior doctor) led by an experienced geriatrician focused on medical, psychological and social aspects of care. These centres are also known as Comprehensive geriatric assessment (CGA) units[5].

Most geriatric patients are frail and would need expedited care, yet age is not a discriminator in the South Africa Triage Score (SATS) used in emergency centres.[6] It is therefore left to the physician's discretion to evaluate a patient aside from their triage score. However, some emergency centres in the Western Cape have put more deliberate measures in place in order to flag geriatric patients. Examples are a separate folder box for geriatric patients or to print the age of a geriatric patient using a bigger and bold font than for non-geriatric patients. For these reasons waiting times might vary amongst different emergency centres within the Western Cape.

Adult patients attending emergency centres can roughly be grouped into those presenting with medical illnesses and those presenting due to trauma. There is an assumption that geriatric patients mostly present with medical illnesses, but they are also very prone to injury. This could be related to musculoskeletal causes (e.g. lack of muscle strength, osteoporotic age-related changes), neurological causes (e.g. previous stroke, loss of proprioception), visual disturbances and even side-effects from polypharmacy. It thus important to always consider the underlying cause when geriatric patients present to the emergency centre with injuries.

There is also a high prevalence (20-30%) of dehydration in the geriatric population[7]. Dehydration associated with hypernatremia further increases mortality in this patient group[8][9]. However, clinical signs are not very sensitive to determine the dehydration status of geriatric patients[10], while the serum sodium level seems to be a more reliable indicator. The prevalence of hypernatremia amongst geriatric patients presenting to the emergency centre in South Africa remains unknown, since previous studies have only described the prevalence in the general population[8].

Motivation

Limited data is available that describe geriatric patients presenting to emergency centres in South Africa, despite the unprecedented growth in this population group. Better knowledge of the burden of this special population in the emergency centre will have many advantages. Data could be used to direct education and quality improvement by providing geriatric-specific training. It might also assist in identifying the need to build an interdisciplinary team to care for geriatric patients both in the hospital and community setting. Furthermore, the results could inform policy in emergency centres which improve patient flow, taking into account the unique medical needs of the geriatric patient as well as having appropriate physical structures. Better knowledge would also allow a more customised and comprehensive approach to the treatment of geriatric patients; subsequently improving outcomes in this special population.

To our knowledge, no study has described the burden of geriatric patients presenting to district-level emergency centres in South Africa.

Objectives

The primary objective is to describe the characteristics of geriatric patients (≥65 years) presenting to the emergency centre of a district-level hospital in Cape Town.

Secondary objectives are:

i. To determine time intervals for geriatric patients
ii. To determine the prevalence of hypernatremia in geriatric patients
iii. To determine the burden of polypharmacy in the geriatric population.

METHODS

Study design

A retrospective analysis of a prospectively collected observational database will be conducted of a period of twelve months. This will be supplemented by a retrospective chart review to include additional variables.

Study setting

Khayelitsha Hospital is a 300-bed hospital situated in the bustling township of Khayelitsha, Cape Town. It provides adult and paediatric emergency services as well as inpatient services such as surgical, medical, paediatric and obstetrics to a predominantly Black African population of close to 400 000[11]. Khayelitsha Hospital's emergency centre is larger than that of a standard district hospital in the Western Cape and has a well-equipped 4-bed resuscitation room. It manages a significant number of emergencies with about 20% high acuity geriatric patients[11].

Study population

The electronic Khayelitsha Hospital Emergency Centre database is a prospectively collected observational database capturing all patients managed within the resuscitation area since 1 November 2014. Data are captured electronically, are coded and stored onto a password protected server. A decoding sheet is separately stored. The database has been registered at the Stellenbosch University Health Research Ethics Committee (Ref: N15/10/107) as well as at the National Health Research Database (Ref: WC_2014RP10_967).

All geriatric patients (≥ 65 years) in the Khayelitsha Hospital Emergency Centre database that were managed in the emergency centre from 01 January 2018 to 31December 2018 will be included. Patients with missing folders or incorrect folder numbers will be excluded.

We expect a sample size of about 350, based on a quick review of the database.

Data collection and management

Data will be collected by the investigators on site at Khayelitsha Hospital after a decoded cleaned extract of the database has been obtained (cleaned: copied into an Excel spreadsheet with all non-geriatric cases removed). The Excel spreadsheet will then be further populated through the electronic clinical record. The following variables will be collected:

- Patient demographics (Age; Gender)
- Patient acuity (according to the South African Triage Scale)
- Date and time of presentation
- Transport method
- Admission category (Medical; Trauma)
- Mechanism of Injury (if applicable)
- Class and Number of medications used
- Type and number of comorbidities
- Number of emergency visits within the past year
- Diagnostic tests performed and their results
- Specific diagnosis
- Interventions received in the resuscitation unit
- Length of stay in the resuscitation unit
- Disposition from the resuscitation unit
- In-hospital mortality
- Length of hospital stay

A personal computer, with a password protected account, will be used for data capture and storage. Patient folder numbers, the main identifier used, will be removed once data capture is completed per patient. Each patient will be given a unique number linked to the patient folder number. A decoding sheet will be separately stored with access privileges limited to the principal investigator. Back-up will occur twice a week on a Stellenbosch University server. Upon completion of the study, two copies of the de-identified electronic database will be backed-up for long term storage: one on a Stellenbosch University server, and one on an external hard drive that will be kept secure in a locked cabinet within the offices of the Division of Emergency Medicine at Stellenbosch University. Data will be stored for at least five years after which it will be destroyed.

Statistical analysis

Incomplete data points will be excluded from analysis. Summary statistics will be used to describe all variables. Categorical data will be summarised using frequency counts or percentages, and distributions of variables will be presented as two-way tables or bar charts. Medians or means will be used as the measures of central tendency for ordinal and continuous responses and standard deviations or quartiles as indicators of spread. Analysis will be done using SPSS Statistics for Windows, Version 25.0 (IBM Corp. Released 2017. Armonk, NY: IBM Corp.).

A STROBE checklist will be used to structure the final report.[12]

Projected timeline

- HREC approval: December 2019
- Institutional approval: February 2020
- Data collection & management: March – April 2020
- Data analysis: May – June 2020
- Write up: July – August 2020

ETHICAL CONSIDERATIONS

The study will be conducted according to the guidelines for research involving human subject as reported by the Declaration of Helsinki 2013 and the South African Medical Research Council (MRC).

Risks and benefits

As this study will not involve direct or indirect patient care, risk to patients is likely minimal. Potential risk due to unauthorised access to patient data is however possible. For this reason, identifiable data will be de-identified and removed as soon as the data collection for that specific patient is completed. There is no direct benefit to participants; however, having a better idea of the specific burden and characteristics of geriatric patients at a district-level hospital emergency centre may lead to improved waiting times, more comprehensive treatment plans and better physician and patient satisfaction.

Informed consent process

The database from which the initial data will be drawn is registered with the Stellenbosch University Health Research Ethics Committee (Ref: N15/10/107) as well as on the National Health Research Database (Ref: WC_2014RP10_967). The information obtained from the database will be supplemented from the patient record. As this will be retrospective, taking individual consent will be near impossible and a disproportionate effort will be needed. There is also no interest in individual patients, nor individual healthcare personnel. We thus request a waiver of informed consent.

Privacy and confidentiality

As described earlier, the study will make use of a combination of safeguards to ensure anonymity of study subjects. This will include on-site data management using a password protected electronic platform containing the data sample, and coding data immediately after data collection is completed.

Institutional approval for the study will be sought via the National Health Research Database once ethical approval has been obtained.

LIMITATIONS

This is a retrospective study and therefore has inherent risks of error and missing information.

Missing data allow for selection bias by allowing preference for study subjects with complete data. Patients with missing data will be reported and will (where possible) not be excluded from analysis; only the incomplete data points will be excluded.

REPORTING AND IMPLEMENTATION OF RESULTS

Publication as an original article or short report in a peer reviewed journal is anticipated, as well as a presentation at an international or national conference. The study results will also be distributed to the management team of Khayelitsha Hospital's Emergency Centre.

RESOURCES

Resource utilisation

Resources used will be mainly non-clinical. As most patients' information will be electronically available, Khayelitsha hospital clerks will not be utilised to access hard copy folders. The investigators will not conduct the study while on-duty.

Budget

The study will be self- funded

Personal compensation		R0
Principal investigator	*R0*	
Co-investigator	*R0*	
Consultancy services		R0
Statistical services	*R0*	
Travel		R5580
Thirty visits @ R 3.72/km *Return distance between Stellenbosch University & Khayelitsha Hospital = 50km*	*R5580*	
Equipment and furniture		R0
Other		R 625
Telephone, Cell phone, Fax	*R 0*	
Internet and email	*R 50*	
Printing and copying *500v@vR1.15/page*	*R 575*	
TOTAL COST		**R6205**

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https://doi.org/10.1016/j.jclinepi.2007.11.008.

Appendix B. Approval from Health Research Ethics Committee

UNIVERSITEIT STELLENBOSCH UNIVERSITY

Approval Notice

New Application

10/12/2019

Project ID :11577

HREC Reference No: N19/09/119_Sub Study of N15/10/107

Project Title: KDH geriatrics

Dear Dr. Daniel Van Hoving,

The New Application received on 09/09/2019 15:40 was reviewed by members of Health Research Ethics Committee 2 (HREC2) via expedited review procedures on 10/12/2019 and was approved.

Please note the following information about your approved research protocol:

Protocol Approval Date: 10 December 2019

Protocol Expiry Date: 09 December 2020

Please remember to use your Project ID [11577] and Ethics Reference Number [N19/09/119_Sub Study of N15/10/107] on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review

Please note you can submit your progress report through the online ethics application process, available at: Links Application Form Direct Link and the application should be submitted to the HREC before the year has expired. Please see *Forms and Instructions* on our HREC website (www.sun.ac.za/healthresearchethics) for guidance on how to submit a progress report.

The HREC will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see: https://www.westerncape.gov.za/general-publication/health-research-approval-process. Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website https://applyethics.sun.ac.za/Project/View/Index/11577

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

Yours sincerely,

Mr. Francis Masiye,

HREC Coordinator,

Health Research Ethics Committee 2 (HREC2).

National Health Research Ethics Council (NHREC) Registration Number:

REC-130408-012 (HREC1)·REC-230208-010 (HREC2)

Federal Wide Assurance Number: 00001372
Office of Human Research Protections (OHRP) Institutional Review Board (IRB) Number:
IRB0005240 (HREC1)·IRB0005239 (HREC2)

The Health Research Ethics Committee (HREC) complies with the SA National Health Act No. 61 of 2003 as it pertains to health research. The HREC abides by the ethical norms and principles for research, established by the World Medical Association (2013). Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects; the South African Department of Health (2006). Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa (2nd edition); as well as the Department of Health (2015). Ethics in Health Research: Principles, Processes and Structures (2nd edition).

The Health Research Ethics Committee reviews research involving human subjects conducted or supported by the Department of Health and Human Services, or other federal departments or agencies that apply the Federal Policy for the Protection of Human Subjects to such research (United States Code of Federal Regulations Title 45 Part 46); and/or clinical investigations regulated by the Food and Drug Administration (FDA) of the Department of Health and Human Services.

Appendix C. Author guidelines: African Journal of Emergency Medicine

The author guidelines are available at: https://www.elsevier.com/journals/african-journal-of-emergency-medicine/2211-419x/guide-for-authors